

CLAIMS

1. A method of providing counter-pumped Raman amplification in a wavelength division multiplex WDM optical communication system, the communication system including a transmission optical fibre for guiding WDM radiation having a transmission waveband and at least one Raman pump laser for generating pump radiation having a respective pump wavelength and wherein the transmission fibre has a zero dispersion wavelength lying midway between the transmission waveband and the pump wavelength, the method being characterised by de-correlating the longitudinal modes of the pump radiation before coupling the pump radiation into the transmission fibre in a counter propagating direction with respect to the WDM radiation.
2. A method according to Claim 1, in which the pump laser is a Fibre Raman laser.
3. An optical wavelength division multiplex WDM communication system comprising a transmission optical fibre for guiding WDM radiation having a transmission waveband; at least one Raman pump laser for generating pump radiation having a respective pump wavelength and coupling means for coupling the pump radiation into the transmission optical fibre in counter propagating direction with respect to the direction of propagation of the WDM radiation and wherein the transmission fibre has a zero dispersion wavelength lying midway between the transmission waveband and the pump wavelength, the system characterised by de-correlating means for de-correlating the

longitudinal modes of the pump radiation before it is coupled into the transmission fibre.

4. A communication system according to Claim 3, in which the pump laser is a Fibre Raman laser.
5. A communication system according to Claim 3 or Claim 4, in which de-correlating means includes a length of optical fibre having dispersive or non-linear characteristics for de-correlating the longitudinal modes of the pump radiation.
6. A communication system according to Claim 5 and further comprising a filter between the length of fibre and the coupling means for blocking spontaneous emission produced by the Raman effect in the length of fibre.
7. A communication system according to claim 3, in which the de-correlating means comprises a first optical coupler for dividing the pump radiation to propagate along first and second optical paths; a delay element included within one of the optical paths; and second coupling means for re-combining the pump radiation from the first and second optical paths.
8. A communication system according to Claim 7, in which the delay element comprises a length of optical fibre whose length is sufficient to de-correlate the longitudinal modes of the pump radiation.

9. A communication system according to Claim 3, in which the de-correlating element comprises a polarisation divider for dividing the pump radiation to propagate along first and second optical paths; a delay element included within one of the optical paths; and a polarisation combiner for re-combining the pump radiation from the first and second optical paths.
10. A communications system according to Claim 9, in which the delay element comprises a length of optical fibre whose length is sufficient to de-correlate the longitudinal modes of the pump radiation.
11. A communication system according to any one of Claims 3 to 10, and further comprising a plurality of Raman pump lasers each for generating pump radiation having a respective different pump wavelength; a respective de-correlating means for de-correlating the longitudinal modes of the pump radiation; and multiplexing means for combining the pump radiation.
12. A Raman pump module for generating pump radiation having a pump wavelength for coupling into a transmission fibre of an optical wavelength division multiplex WDM communication system to provide Raman amplification of WDM radiation counter propagating there through, the WDM radiation having a transmission waveband; and wherein the transmission fibre has a zero dispersion wavelength lying midway between the transmission waveband and the pump wavelength, the module comprising a Raman pump laser for generating the pump radiation, characterised by de-correlating means

for de-correlating the longitudinal modes of the pump radiation before it is coupled into the transmission fibre.

13. A Raman module according to Claim 12, in which the pump laser is a fibre Raman laser.
14. A Raman module communication according to Claim 12 or Claim 13, in which de-correlating means includes a length of optical fibre having dispersive or non-linear characteristics for de-correlating the longitudinal modes of the pump radiation.
15. A Raman module according to Claim 14 and further comprising a filter between for blocking spontaneous emission produced by the Raman effect in the length of fibre.
16. A Raman module according to claim 12, in which the de-correlating means comprises a first optical coupler for dividing the pump radiation to propagate along first and second optical paths; a delay element included within one of the optical paths; and second coupling means for re-combining the pump radiation from the first and second optical paths.
17. A Raman module according to Claim 16, in which the delay element comprises a length of optical fibre whose length is sufficient to de-correlate the longitudinal modes of the pump radiation.

18. A Raman module according to Claim 12, in which the de-correlating element comprises a polarisation divider for dividing the pump radiation to propagate along first and second optical paths; a delay element included within one of the optical paths; and a polarisation combiner for re-combining the pump radiation from the first and second optical paths.
19. A Raman module according to Claim 18, in which the delay element comprises a length of optical fibre whose length is sufficient to de-correlate the longitudinal modes of the pump radiation.